

University of Alabama at Birmingham (UAB) Study:

The UAB study consisted of performing headspace sampling followed by GC/MS analysis of 30 cm² samples of weathered and non-weathered screen material. Weathered material produced peak heights that were 10 - 200 times larger than non-weathered samples. Tentative identification of a number of low mass, low boiling point compounds emitted by the screening material was made. Compound identifications were tentative because analytical peak areas (a reflection of amounts emitted) were too small to obtain reliable mass spectral identifications. The compounds appeared to be low levels of oxidation products of the screen coating, various phthalates associated with plasticizers used to manufacture the screen, and color pigments.

A second headspace study was conducted at an elevated temperature of 140 °C to increase emission rates and enhance compound identification. Seven specific compounds thought to be oxidation products of the screen material and associated plasticizers were identified with this technique, including ketones, amines, and weak organic acids. A brief review of the toxicity associated with the identified compounds concluded that they can be strong irritants to the nose, eyes, upper respiratory tract, and mucous membranes. No reference to exposure levels associated with such irritant effects was provided. The report stressed that chronic or long-term health effects were not expected from exposures to the degraded screen material.

Envirocomp (EC) Study:

The EC study involved an indoor air quality assessment of a residence in Hatfield, Massachusetts. Objectional odors from selected screens had been reported by the residence owner. The strongest odors were experienced during periods when direct sunlight contacted the screens. It was also reported that the odors were worse when the screens were newer. For purposes of this study, used screens were removed from storage and re-installed the day before sampling was performed.

A faint odor was reported by the residents when sampling was initiated in the afternoon of a sunny day ($T_{out} = 68^{\circ}\text{F}$; $T_{in} = 73^{\circ}\text{F}$). Screened windows were in direct sunlight. 100 liter air samples were collected over a 2-hour period on in-line charcoal and Tenax tubes, which were analyzed by GC/MS. Sample locations were in the vicinity of the offensive screens.

Sample results showed a number of low-level unidentifiable peaks of aliphatic hydrocarbons. Specific compounds identified in all samples included xylenes (all isomers), toluene, ethanol, methyl chloroform, and 2-methyl propane. Measured airborne concentrations ranged from 15 - 83 micrograms per cubic meter of air ($\mu\text{g}/\text{M}^3$). The current OSHA exposure limit for toluene is approximately 4,000 times higher than the highest toluene

The compounds detected in residences during the indoor air quality studies do not generally match the compounds that were identified during the GC/MS analyses of the screen material. This implies that the screens were probably not the source of the compounds measured, which are typically associated with a variety of products often found and used in homes.

Based upon the data generated in the above studies, an association between identified screen emission products and the types of health effects that have been reported is not evident. Compounds identified during the screen analysis studies, with the exception of benzene, can generally be described as potential irritants at high enough concentrations. As demonstrated by the results of the residential air samples, identified screen emission products were not present in the air at the analytical limits of detection, which are more than 10,000 times lower than levels considered to be safe in industry, where such compounds are routinely encountered.

Degraded or weathered screen material has been observed to have a irritating or penetrating odor. This odor was very noticeable in a sample from which identifiable concentrations could not be captured by airborne sampling. This indicates that the compound(s) responsible for the odor has an extremely low odor threshold.

36 ug/M³ of toluene and 300 ug/M³ of 1,1,1-trichloroethane were detected. A list of tentatively identified compounds were present in concentrations ranging from 0.2 - 10 ug/M³.

The USEPA has reported concentrations of hydrocarbons in non-industrial indoor air as follows:

<u>Contaminant</u>	<u>Concentration Range, ug/M³</u>
Aromatic hydrocarbons	21 - 1,100
Aliphatic hydrocarbons	11 - 270

Another paper by B. Siefert that was cited in the study stated that total VOC concentrations indoors greater than 300 ug/M³ are a point of concern to occupants. Total VOC concentrations in one of the three homes tested exceeded this level.

The CEC report on the indoor air quality assessments concluded that the sampling does not clearly indicate that the screen material is the single or even the major contributor.

The second phase of the CEC study involved headspace analyses of samples of screen material by GC/MS at temperatures of 30, 50, and 100 °C. A variety of volatile organics were detected, typically at fractional microgram levels. The highest reported levels were typically ketones, benzene, and phthalates. 1,1,1-trichloroethane was not observed to be a significant emission product from the screens.

CONCLUSIONS

Emissions from polymer coated fiberglass screening material manufactured by PhiFer Wire, Inc. have been characterized in three separate studies. Each study used a gas chromatograph/mass spectrometer to separate and identify compounds that were volatilized from samples of the screen material at elevated temperatures. The samples of screen material were at various stages of degradation that were not characterized by any quantifiable scale.

A variety of compounds, represented as peaks on GC/MS output graphs, were observed in the samples. Most peaks were present in such low concentrations that they could not be reliably identified. Compounds emitted from screen samples at high enough concentrations to be specifically identified have shown a fair degree of consistency. Ketones, benzene, and phthalates seem to be the most prevalent emission products during analyses of the screening material. All compounds were emitted at very low levels.

Table I. A Summary of Types of Studies Conducted on Emissions from Degraded Polymer Coated Fiberglass Screening Material Manufactured by Phifer Wire, Inc.

<u>Code</u>	<u>Date</u>	<u>Type^a</u>	<u>Organization</u>
HEG	11/22/91	1,2	Health Effects Group, Inc. 305 E. Ft. Lowell Tucson, AZ 85705 (C. Crutchfield, Ph.D., CIH)
UAB	2/21/92	2	Department of Environmental Health Sciences The University of Alabama at Birmingham 309 Tidwell Hall, UAB Station Birmingham, AL 35294 (R. Meeks, Ph.D., D.A.B.T.)
EC	10/09/92	3	Envirocomp 125 North Elm Street Westfield, MA 01085 (Unsigned)
CEC	4/13/93 (draft)	2,3	Clayton Environmental Consultants 22345 Roethel Drive P.O. Box 8022 Novi, MI 48375 (Ronald C. Poore, IHIT)

- ^a 1 - Airborne VOC samples collected from sample of screening material enclosed in glass container, analyzed by GC/MS
 2 - Headspace analysis of screening material at elevated temperature by GC/MS
 3 - Airborne samples collected in homes with installed screening material

Indoor Air Quality Evaluation
at
Three Selected Homes
in
Southeastern Michigan
for
Phifer Wire Products, Inc.
Tuscaloosa, Alabama

Clayton Project No. 45870.00
Draft Report

April 13, 1993

1.0 INTRODUCTION

Mr. Charles E. Morgan, Executive Vice President and Corporate Counsel at Phifer Wire Products, Inc., authorized Clayton Environmental Consultants, Inc. to perform an indoor air quality evaluation in three selected homes in southeastern Michigan. These three households in southeastern Michigan have submitted a variety of complaints, including foul odors, coughing, allergies, burning eyes, and upper respiratory infections that they have associated with the presence of Phifer Wire Products, window screening in their homes. This report provides the results of Clayton's field evaluations.

Mr. Ronald C. Poore, Industrial Hygienist at Clayton, performed three field evaluations on January 18, 1993. The addresses of the three homes evaluated are listed below.

Mr. and Mrs. Golarz
6710 Sun Valley Drive
Clarkston, Michigan

Mr. and Mrs. King
5237 Sun Valley Court
Clarkston, Michigan

Mr. and Mrs. Fullerton
6859 Tanglewood Street
Waterford, Michigan

The purpose of these evaluations was to review the indoor air quality in each of the homes and sample for potential airborne contaminants. The scope of Clayton's services was outlined in Clayton's proposal, which was dated December 3, 1992, addressed to Mr. Morgan, and provided an explanation of the Terms and Conditions under which this work was performed.

Appendix A presents the direct-reading environmental measurements obtained during the field assessments. Appendix B provides the evaluation criteria for indoor air quality used in the home evaluations. Appendix C provides tabulated analytical results of air sampling performed during the home evaluations.

2.0 HOME EVALUATIONS

The findings of Clayton's indoor air quality evaluations are based on visual observations and direct-reading measurements obtained in the occupied spaces of the three homes.

2.1 OCCUPIED SPACE

The three homes are multistoried (including basement), single family residences. The Golarz and King homes are free standing and the Fullerton residence is an attached condominium. The three homes have forced-air, gas-powered furnaces with attached humidifiers and electronic air cleaners.

Renovation and construction materials (e.g., carpeting) emit volatile organic compounds (VOCs), which can be irritating and cause discomfort to sensitive individuals. Research suggests that (1) most offgassing from these materials occurs during the first 6 months after installation, and (2) offgassing can be effectively controlled by providing adequate outdoor air to the occupied space. In each of the three cases, the residents have been living in the homes for at least 3.5 years. Mr. Poore did not detect a new carpet odor or observe unusual sources of VOCs in the three homes.

for each amine based on the method and air volume collected. Analytical results for the inorganic acids and amines analyses are provided in Appendix C.

3.2 VOLATILE ORGANIC COMPOUNDS

3.2.1 6710 Sun Valley Drive in Clarkston, Michigan

The analytical results of the sample collected for VOCs in the household air at 6710 Sun Valley Drive indicated an airborne benzene concentration of $7.2 \mu\text{g}/\text{m}^3$, an ethylbenzene concentration of $3.3 \mu\text{g}/\text{m}^3$, a styrene concentration of $6.9 \mu\text{g}/\text{m}^3$, a toluene concentration of $7.6 \mu\text{g}/\text{m}^3$, and a xylenes (o-, m-, and p- isomers) concentration of $12 \mu\text{g}/\text{m}^3$. Other tentatively identified compounds included limonene at a concentration of $9.2 \mu\text{g}/\text{m}^3$, benzofuran at $2.7 \mu\text{g}/\text{m}^3$, butyl acetate at $6.5 \mu\text{g}/\text{m}^3$, hexamethyl cyclotrisiloxane at $0.4 \mu\text{g}/\text{m}^3$, and aliphatic and aromatic hydrocarbon concentrations ranging from 0.2 to $25 \mu\text{g}/\text{m}^3$. The total hydrocarbon concentration in this home was $86.4 \mu\text{g}/\text{m}^3$.

3.2.2 5237 Sun Valley Court in Clarkston, Michigan

The analytical results of the sample collected for VOCs in the household air at 5237 Sun Valley Court indicated an airborne benzene concentration of $0.5 \mu\text{g}/\text{m}^3$, an ethylbenzene concentration of $4.2 \mu\text{g}/\text{m}^3$, a styrene concentration of $3.8 \mu\text{g}/\text{m}^3$, a toluene concentration of $36 \mu\text{g}/\text{m}^3$, a 1,1,1-trichloroethane concentration of $300 \mu\text{g}/\text{m}^3$, a trichloroethene concentration of $2.0 \mu\text{g}/\text{m}^3$, and a xylenes (o-, m-, and p- isomers) concentration of $17 \mu\text{g}/\text{m}^3$. Other tentatively identified compounds at this residence include limonene at an airborne concentration of $1.3 \mu\text{g}/\text{m}^3$, pyrrolidine at $0.3 \mu\text{g}/\text{m}^3$, and aliphatic and aromatic hydrocarbons ranging from 0.3 to $1.5 \mu\text{g}/\text{m}^3$. The total hydrocarbon concentration in this home was $370.2 \mu\text{g}/\text{m}^3$.

3.2.3 6859 Tanglewood Street in Waterford, Michigan

The analytical results of the sample collected for VOCs in household air at 6859 Tanglewood Street indicated an airborne benzene concentration of $2 \mu\text{g}/\text{m}^3$, an ethylbenzene concentration of $2 \mu\text{g}/\text{m}^3$, a styrene concentration of $1 \mu\text{g}/\text{m}^3$, a toluene concentration of $7.8 \mu\text{g}/\text{m}^3$, and a xylenes (o-, m-, and p- isomers) concentration of $7.4 \mu\text{g}/\text{m}^3$. Other tentatively identified compounds at this residence include limonene at a concentration of $8.3 \mu\text{g}/\text{m}^3$, hexamethyl cyclotrisiloxane at $1 \mu\text{g}/\text{m}^3$, octamethyl cyclotetrasiloxane at $0.3 \mu\text{g}/\text{m}^3$, and aliphatic and aromatic hydrocarbons at concentrations ranging from 0.9 to $10 \mu\text{g}/\text{m}^3$. The total hydrocarbon concentration in this home was $64.2 \mu\text{g}/\text{m}^3$.

4.0 METHODS AND MATERIALS

Clayton's American Industrial Hygiene Association-accredited laboratories in Edison, New Jersey, and Novi, Michigan, analyzed the air samples collected during these assessments. The sampling equipment used to collect air samples was calibrated before and after sample collection using a primary standard.

Air samples were collected in each home for amines, inorganic acids, and VOCs. In each case, samples were collected in one room of the house. The doors were closed after the air sampling began and no one entered the rooms until the sampling was completed.

5.0 DISCUSSION OF AIR SAMPLING

Results of the home evaluations indicated that there are sources for VOCs in each of the three homes. The following compounds were detected in one or more of the homes:

- Benzene
- Ethylbenzene
- Styrene
- Toluene
- 1,1,1- Trichloroethane
- Xylenes

Each of the compounds detected are common to modern households. Benzene is found in paints and stains, and is used as an intermediate compound in the production of nylon. Ethyl benzene is a common solvent and an intermediate compound in the production of styrene. Styrene is used in furniture construction and is also used in molded household containers. Toluene is found in gums, resins, and coatings used in households. 1,1,1- Trichloroethane is a common solvent used in degreasing solutions, in pesticides, and in textile processing. Xylene is a common solvent found in lacquers, enamels, and rubber cements. During Clayton's evaluations of the three homes, concentrations of the above compounds ranged from less than 0.1 to 300 $\mu\text{g}/\text{m}^3$.

During interviews, the homeowners expressed interest in medical monitoring to determine exposure, if any, to the compounds found in the evaluation. Compounds and their biological exposure index (BEI) are provided below for the homeowners' information only.

<u>Compound</u>	<u>Biological Exposure Index</u>
Benzene	Phenol in urine Benzene in blood
Ethylbenzene	Mandelic acid in urine Ethylbenzene in blood
Styrene	Mandelic acid in urine Phenylglyoxylic acid in urine Styrene in blood
Toluene	Hippuric acid in urine Toluene in blood
1,1,1- Trichloroethane (Methyl chloroform)	Sum of trichloroethanol & trichloroacetic acid in urine 1,1,1- Trichloroethane in blood
Xylenes	Methyl hippuric acid in urine Xylene in blood

DRAFT

Ashford and Miller (1989. Chemical Sensitivity, a Report to the New Jersey State Department of Health) have summarized studies that were conducted to link multiple chemical sensitivity to exposure to VOCs and other organic compounds.

In a protocol described in a paper by B. Siefert (Regulating Indoor Air, Indoor Air '90 Proceedings of the 5th International Conference on Indoor Air Quality, Vol. 1, Ottawa, 1990) total VOC concentrations indoors greater than $300 \mu\text{g}/\text{m}^3$ are a point of concern to occupants. Total VOC concentration exceeded $300 \mu\text{g}/\text{m}^3$ at 5237 Sun Valley Court in Clarkston, Michigan.

A major difficulty when attempting to identify sources of emissions in buildings is that some porous indoor building materials act as sinks for VOCs from other sources. That is, VOCs from one source may adsorb to the surface of a porous material in the room. When the porous surface is ventilated by clean air, the VOC will be emitted into the room air.

While it is possible that the screening material manufactured by Phifer Wire Products, Inc. and installed in these three homes did contribute to the potential occupants' overall exposure to VOCs, the sampling does not clearly indicate that the screen material is the single or even the major contributor.

At the home located at 6859 Tanglewood Street in Waterford, 12 window screens were placed in a secluded sealed room at an elevated temperature (82°F). This increased temperature would increase the offgassing of compounds into the room air. Results of analysis of samples collected in this room indicated VOC concentrations comparable to the concentrations found in the other two homes and those concentrations noted in the research cited in this section.

This report submitted by:

Ronald C. Poore, IHIT
Industrial Hygienist

This report reviewed by:

Stephen D. Paul, CIH
Manager, Industrial Hygiene Services
Midwestern Operations

April 13, 1993

Direct-Reading Measurements
at
Three Homes
in
Clarkston and Waterford, Michigan
for
Phifer Wire Products, Inc.
Tuscaloosa, Alabama

Clayton Project No. 45870.00

Measurement Date: January 18, 1993

Location	Military Time	Temperature (F°)	Relative Humidity (%)	Carbon Dioxide (ppm) ^a	Airborne Particulate (µg/m ³) ^b
<u>Outdoors</u>	1015	28	63	300	9
6710 Sun Valley Drive	1030	78.5	26.1	400	20
5237 Sun Valley Court	1352	75.2	22.0	450	10
6859 Tanglewood	1240	73.8	20.5	400	10
Basement storage room 6859 Tanglewood (Temperature maintained for air sampling)	1240	82.5	19.0	400	11
Outdoors	1600	27	61	300	7

^a parts of carbon dioxide per million parts of air, on a volume-to-volume basis

^b micrograms of particulate per cubic meter of air, on a weight-to-volume basis

The following criteria were used to evaluate the indoor air quality in the three homes.

VENTILATION SYSTEM

American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc. (ASHRAE) Standard 62-1989 (Ventilation for Acceptable Indoor Air Quality, Atlanta, 1989) recommends that outdoor air should be supplied to the breathing zone at a flowrate of at least 15 to 20 cubic feet per minute (cfm) per occupant. The occupied space in living areas should be supplied with sufficient outdoor air to assure the air pressure differential is slightly positive relative to the outdoor atmosphere.

CARBON DIOXIDE

Carbon dioxide has been widely used in the industrial hygiene community as a surrogate for various occupant-generated indoor contaminants, such as cigarette smoke and bioeffluents, that are known to cause annoyance, irritation, or discomfort among building occupants (P. Morey, W. Jones, J. Clere, et al., "Studies on Sources of Airborne Microorganisms and on Indoor Air Quality in a Large Office Building." *IAQ '86 Managing Indoor Air for Health and Energy Conservation*. ASHRAE, Atlanta, 1986, pp. 500-509).

For buildings or zones of buildings where air cleaning to remove smoke and bioeffluents is not provided, performance criteria establishing a limit of 1,000 parts per million (ppm) carbon dioxide (equivalent to about 15 to 20 cfm outdoor air per occupant) are recommended to satisfy occupant comfort needs.

AIRBORNE PARTICULATE

ASHRAE Standard 62-1989 recommends that levels of total particulate in outdoor air entering a building not exceed the United States Environmental Protection Agency (USEPA) National Ambient Air Quality Standards (NAAQS) of 75 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Air containing higher levels of particulate must be filtered to bring particulate levels within guidelines.

An addendum to Standard 62-1989 (Addendum to Ventilation for Acceptable Indoor Air Quality) recommends that, in accordance with the Clean Air Act of 1987, levels of respirable particulate (particles of less than 10 micron aerodynamic diameter) not exceed 50 $\mu\text{g}/\text{m}^3$ in outdoor air entering a building.

Clayton has set maximum indoor air concentration guidelines for total suspended particulate at 75 $\mu\text{g}/\text{m}^3$ and for respirable particulate at 50 $\mu\text{g}/\text{m}^3$. These evaluation criteria reflect our view that performance guidelines for indoor air should at a minimum comply with provisions of the Clean Air Act (USEPA-NAAQS) for outdoor air.

APPENDIX C
RESULTS OF SAMPLING AND ANALYSIS

Table 2
Results of Air Sampling and Analysis for Inorganic Acids
at
Three Selected Homes
in
Clarkston and Waterford, Michigan
for
Phifer Wire Products, Inc.
Tuscaloosa, Alabama
Clayton Project No. 45870.00
Sampling Date: January 18, 1993

Sample Number	Description	Sampling Period Start Stop	Volume (Liters)	Hydrogen fluoride (ppm)	Hydrogen bromide (ppm)	Hydrogen Chloride (ppm)	Nitric acid (ppm)	Phosphoric acid (ppm)
PH-3	6710 Sun Valley Drive Clarkston, Michigan	1025 1600	67.4	<0.05	<0.06	<0.13	<0.08.	<0.099
PH-4	5237 Sun Valley Court Clarkston, Michigan	1105 1620	65.1	<0.05	<0.06	<0.13	<0.08	<0.0099
PH-9	6859 Tanglewood Street Waterford, Michigan	1230 1645	51.0	<0.05	<0.06	<0.13	<0.08	<0.0099

ppm means parts of contaminant gas or vapor per million parts of air, on a volume-to-volume basis
< means "less than"

Analytical Data
for
Phifer Wire Products
Clayton Project No. 45870.00/B012107087

Sample Matrix/Media:	Tenax Tubes	Date Sampled:	1/18/93
Analytical Method:	Thermal Desorption, GC/MS	Date Received:	1/21/93
Lab Number:	179223	Date Analyzed:	1/27/93
Sample Identification:	PH-1	Air Volume:	100 L ^a

Compound	Concentration ^b	
	(μg)	($\mu\text{g}/\text{m}^3$)

Tentatively Identified Compounds^c

C10 Aliphatic Hydrocarbons	0.51	5.1
C9 Aromatic Hydrocarbons	2.5	25
C10 Aromatic Hydrocarbons	0.02	0.2
Limonene	0.92	9.2
Butyl Acetate	0.65	6.5
Hexamethyl Cyclotrisiloxane	0.04	0.4
Benzofuran	0.27	2.7

^aAirborne concentrations are based on the air volume provided.

^bResults have been blank corrected.

^cTentatively Identified Compound results are based on nearest internal standard.

Analytical Data
for
Phifer Wire Products
Clayton Project No. 45870.00/B012107087

Sample Matrix/Media:	Tenax Tubes	Date Sampled:	1/18/93
Analytical Method:	Thermal Desorption, GC/MS	Date Received:	1/21/93
Lab Number:	179224	Date Analyzed:	1/27/93
Sample Identification:	PH-5	Air Volume:	100 L ^a

Compound	Concentration ^b	
	(μg)	($\mu\text{g}/\text{m}^3$)

Tentatively Identified Compounds^c

C5 Aliphatic Hydrocarbons	0.09	0.9
C8 Aliphatic Hydrocarbons	0.12	1.2
C10 Aliphatic Hydrocarbons	0.15	1.5
C11 Aliphatic Hydrocarbons	0.03	0.3
C9 Aromatic Hydrocarbons	0.12	1.2
Limonene	0.13	1.3
Pyrrolidine	0.03	0.3

^aAirborne concentrations are based on the air volume provided.

^bResults have been blank corrected.

^cTentatively Identified Compound results are based on nearest internal standard.

Analytical Data
for
Phifer Wire Products
Clayton Project No. 45870.00/B012107087

Sample Matrix/Media:	Tenax Tubes	Date Sampled:	1/18/93
Analytical Method:	Thermal Desorption, GC/MS	Date Received:	1/21/93
Lab Number:	179225	Date Analyzed:	1/27/93
Sample Identification:	PH-7	Air Volume:	54 L ^a

Compound	Concentration ^b	
	(μg)	($\mu\text{g}/\text{m}^3$)

Tentatively Identified Compounds^c

C6 Aliphatic Hydrocarbons	0.05	0.9
C7 Aliphatic Hydrocarbons	0.33	6.1
C9 Aliphatic Hydrocarbons	0.13	2.4
C10 Aliphatic Hydrocarbons	0.17	3.1
C11 Aliphatic Hydrocarbons	0.07	1.3
C13 Aliphatic Hydrocarbons	0.54	10.
C9 Aromatic Hydrocarbons	0.41	7.6
C10 Aromatic Hydrocarbons	0.15	2.8
Limonene	0.45	8.3
Hexamethyl Cyclotrisiloxane	0.07	1
Octamethyl Cyclotrisiloxane	0.02	0.3

^aAirborne concentrations are based on the air volume provided.

^bResults have been blank corrected.

^cTentatively Identified Compound results are based on nearest internal standard.

APPENDIX D
RESULTS
OF
LABORATORY GAS CHROMATOGRAPHY/MASS SPECTROSCOPY
(GC/MS) STUDY

Analytical Results
for
Phifer Wire Products

Clayton Project No. 46431-17

Sample Matrix/Media: Screens Date Prepared: 03/04/93
Lab Number: ----- >C9377 Date Analyzed: 03/04/93
Sample Identification: LAB BLANK
Analytical Method: EPA T01 (Modified)

<u>Volatile Compounds</u>	<u>Concentration</u> <u>(ug)</u>	<u>Limit of</u> <u>Detection</u> <u>(ug)</u>
Acetone	<0.1	0.1
Benzene	<0.01	0.01
Bromodichloromethane	<0.01	0.01
Bromoform	<0.01	0.01
2-Butanone	<0.1	0.1
Carbon disulfide	<0.01	0.01
Carbon tetrachloride	<0.01	0.01
Chlorobenzene	<0.01	0.01
Chloroform	<0.01	0.01
Dibromochloromethane	<0.01	0.01
1,1-Dichloroethane	<0.01	0.01
1,2-Dichloroethane	<0.01	0.01
1,1-Dichloroethene	<0.01	0.01
1,2-Dichloroethene (total)	<0.01	0.01
1,2-Dichloropropane	<0.01	0.01
cis-1,3-Dichloropropene	<0.01	0.01
trans-1,3-Dichloropropene	<0.01	0.01
Ethylbenzene	<0.01	0.01
2-Hexanone	<0.05	0.05
Methylene chloride	<0.05	0.05
4-Methyl-2-pentanone	<0.05	0.05
Styrene	<0.01	0.01
1,1,2,2-Tetrachloroethane	<0.01	0.01
Tetrachloroethene	<0.01	0.01
Toluene	<0.01	0.01
1,1,1-Trichloroethane	<0.01	0.01
1,1,2-Trichloroethane	<0.01	0.01
Trichloroethene	<0.01	0.01
Vinyl acetate	<0.05	0.05
Xylenes (total)	<0.01	0.01

Analytical Results
for
Phifer Wire Products

Clayton Project No. 46431-17

Sample Matrix/Media:	Screens	Date Received:	02/08/93
Lab Number:	126823 >C9230	Date Analyzed:	02/16/93
Sample Identification:	PH-F-1	Temperature:	30
Analytical Method:	EPA T01 (Modified)		

<u>Volatile Compounds</u>	<u>Concentration*</u> <u>(ug)</u>	<u>Limit of</u> <u>Detection</u> <u>(ug)</u>
Acetone	0.3	0.1
Benzene	0.07	0.01
Bromodichloromethane	<0.01	0.01
Bromoform	<0.01	0.01
2-Butanone	0.1	0.1
Carbon disulfide	<0.01	0.01
Carbon tetrachloride	<0.01	0.01
Chlorobenzene	0.01	0.01
Chloroform	<0.01	0.01
Dibromochloromethane	<0.01	0.01
1,1-Dichloroethane	<0.01	0.01
1,2-Dichloroethane	<0.01	0.01
1,1-Dichloroethene	<0.01	0.01
1,2-Dichloroethene (total)	<0.01	0.01
1,2-Dichloropropane	<0.01	0.01
cis-1,3-Dichloropropene	<0.01	0.01
trans-1,3-Dichloropropene	<0.01	0.01
Ethylbenzene	<0.01	0.01
2-Hexanone	0.05	0.05
Methylene chloride	<0.05	0.05
4-Methyl-2-pentanone	<0.05	0.05
Styrene	0.01	0.01
1,1,2,2-Tetrachloroethane	<0.01	0.01
Tetrachloroethene	<0.01	0.01
Toluene	0.02	0.01
1,1,1-Trichloroethane	<0.01	0.01
1,1,2-Trichloroethane	<0.01	0.01
Trichloroethene	<0.01	0.01
Vinyl acetate	<0.05	0.05
Xylenes (total)	<0.01	0.01

* Results are blank corrected.

Analytical Results
for
Phifer Wire Products

Clayton Project No. 46431-17

Sample Matrix/Media:	Screens	Date Received:	02/08/93
Lab Number:	126823 >C9229	Date Analyzed:	02/16/93
Sample Identification:	PH-F-1	Temperature:	50
Analytical Method:	EPA T01 (Modified)		

<u>Volatile Compounds</u>	<u>Concentration*</u> <u>(ug)</u>	<u>Limit of</u> <u>Detection</u> <u>(ug)</u>
Acetone	0.3	0.1
Benzene	0.16	0.01
Bromodichloromethane	<0.01	0.01
Bromoform	<0.01	0.01
2-Butanone	0.1	0.1
Carbon disulfide	<0.01	0.01
Carbon tetrachloride	<0.01	0.01
Chlorobenzene	0.01	0.01
Chloroform	<0.01	0.01
Dibromochloromethane	<0.01	0.01
1,1-Dichloroethane	<0.01	0.01
1,2-Dichloroethane	<0.01	0.01
1,1-Dichloroethene	<0.01	0.01
1,2-Dichloroethene (total)	<0.01	0.01
1,2-Dichloropropane	<0.01	0.01
cis-1,3-Dichloropropene	<0.01	0.01
trans-1,3-Dichloropropene	<0.01	0.01
Ethylbenzene	<0.01	0.01
2-Hexanone	0.11	0.05
Methylene chloride	<0.05	0.05
4-Methyl-2-pentanone	<0.05	0.05
Styrene	0.04	0.01
1,1,2,2-Tetrachloroethane	<0.01	0.01
Tetrachloroethene	<0.01	0.01
Toluene	<0.01	0.01
1,1,1-Trichloroethane	<0.01	0.01
1,1,2-Trichloroethane	<0.01	0.01
Trichloroethene	<0.01	0.01
Vinyl acetate	<0.05	0.05
Xylenes (total)	<0.01	0.01

* Results are blank corrected.

Analytical Results
for
Phifer Wire Products

Clayton Project No. 46431-17

Sample Matrix/Media:	Screens	Date Received:	02/08/93
Lab Number:	126823 >C9378	Date Analyzed:	03/04/93
Sample Identification:	PH-F-1	Temperature:	100
Analytical Method:	EPA T01 (Modified)		

<u>Volatile Compounds</u>	<u>Concentration*</u> <u>(ug)</u>	<u>Limit of</u> <u>Detection</u> <u>(ug)</u>
Acetone	0.2	0.1
Benzene	<0.01	0.01
Bromodichloromethane	<0.01	0.01
Bromoform	<0.01	0.01
2-Butanone	<0.1	0.1
Carbon disulfide	<0.01	0.01
Carbon tetrachloride	<0.01	0.01
Chlorobenzene	<0.01	0.01
Chloroform	<0.01	0.01
Dibromochloromethane	<0.01	0.01
1,1-Dichloroethane	<0.01	0.01
1,2-Dichloroethane	<0.01	0.01
1,1-Dichloroethene	<0.01	0.01
1,2-Dichloroethene (total)	<0.01	0.01
1,2-Dichloropropane	<0.01	0.01
cis-1,3-Dichloropropene	<0.01	0.01
trans-1,3-Dichloropropene	<0.01	0.01
Ethylbenzene	<0.01	0.01
2-Hexanone	<0.05	0.05
Methylene chloride	<0.05	0.05
4-Methyl-2-pentanone	<0.05	0.05
Styrene	<0.01	0.01
1,1,2,2-Tetrachloroethane	<0.01	0.01
Tetrachloroethene	<0.01	0.01
Toluene	0.02	0.01
1,1,1-Trichloroethane	<0.01	0.01
1,1,2-Trichloroethane	<0.01	0.01
Trichloroethene	<0.01	0.01
Vinyl acetate	<0.05	0.05
Xylenes (total)	<0.01	0.01

* Results are blank corrected.

Analytical Results
for
Phifer Wire Products

Clayton Project No. 46431-17

Sample Matrix/Media:	Screens	Date Received:	02/08/93
Lab Number:	126824 >C9231	Date Analyzed:	02/16/93
Sample Identification:	PH-G-2 (1992)	Temperature:	30
Analytical Method:	EPA T01 (Modified)		

<u>Volatile Compounds</u>	<u>Concentration*</u> <u>(ug)</u>	<u>Limit of</u> <u>Detection</u> <u>(ug)</u>
Acetone	0.8	0.1
Benzene	1.1	0.01
Bromodichloromethane	<0.01	0.01
Bromoform	<0.01	0.01
2-Butanone	0.2	0.1
Carbon disulfide	0.02	0.01
Carbon tetrachloride	<0.01	0.01
** Chlorobenzene	0.06	0.01
Chloroform	<0.01	0.01
Dibromochloromethane	<0.01	0.01
1,1-Dichloroethane	<0.01	0.01
1,2-Dichloroethane	<0.01	0.01
1,1-Dichloroethene	<0.01	0.01
1,2-Dichloroethene (total)	<0.01	0.01
1,2-Dichloropropane	<0.01	0.01
cis-1,3-Dichloropropene	<0.01	0.01
trans-1,3-Dichloropropene	<0.01	0.01
** Ethylbenzene	0.08	0.01
** 2-Hexanone	<0.05	0.05
Methylene chloride	<0.05	0.05
** 4-Methyl-2-pentanone	<0.05	0.05
** Styrene	0.10	0.01
** 1,1,2,2-Tetrachloroethane	<0.01	0.01
** Tetrachloroethene	<0.01	0.01
** Toluene	0.10	0.01
1,1,1-Trichloroethane	<0.01	0.01
1,1,2-Trichloroethane	<0.01	0.01
Trichloroethene	<0.01	0.01
Vinyl acetate	<0.05	0.05
** Xylenes (total)	0.11	0.01

* Results are blank corrected.

** Concentrations are estimated due to low Internal Standard recovery.

Analytical Results
for
Phifer Wire Products

Clayton Project No. 46431-17

Sample Matrix/Media:	Screens	Date Received:	02/08/93
Lab Number:	126824 >C9226	Date Analyzed:	02/16/93
Sample Identification:	PH-G-2 (1992)	Temperature:	50
Analytical Method:	EPA T01 (Modified)		

<u>Volatile Compounds</u>	<u>Concentration*</u> <u>(ug)</u>	<u>Limit of</u> <u>Detection</u> <u>(ug)</u>
Acetone	0.3	0.1
Benzene	0.16	0.01
Bromodichloromethane	<0.01	0.01
Bromoform	<0.01	0.01
2-Butanone	0.1	0.1
Carbon disulfide	<0.01	0.01
Carbon tetrachloride	<0.01	0.01
Chlorobenzene	0.02	0.01
Chloroform	<0.01	0.01
Dibromochloromethane	<0.01	0.01
1,1-Dichloroethane	<0.01	0.01
1,2-Dichloroethane	<0.01	0.01
1,1-Dichloroethene	<0.01	0.01
1,2-Dichloroethene (total)	<0.01	0.01
1,2-Dichloropropane	<0.01	0.01
cis-1,3-Dichloropropene	<0.01	0.01
trans-1,3-Dichloropropene	<0.01	0.01
Ethylbenzene	<0.01	0.01
2-Hexanone	0.07	0.05
Methylene chloride	<0.05	0.05
4-Methyl-2-pentanone	<0.05	0.05
Styrene	0.04	0.01
1,1,2,2-Tetrachloroethane	<0.01	0.01
Tetrachloroethene	0.01	0.01
Toluene	0.03	0.01
1,1,1-Trichloroethane	0.02	0.01
1,1,2-Trichloroethane	<0.01	0.01
Trichloroethene	<0.01	0.01
Vinyl acetate	<0.05	0.05
Xylenes (total)	0.03	0.01

* Results are blank corrected.

Analytical Results
for
Phifer Wire Products

Clayton Project No. 46431-17

Sample Matrix/Media:	Screens	Date Received:	02/08/93
Lab Number:	126824 >C9379	Date Analyzed:	03/04/93
Sample Identification:	PH-G-2 (1992)	Temperature:	100
Analytical Method:	EPA T01 (Modified)		

<u>Volatile Compounds</u>	<u>Concentration*</u> <u>(ug)</u>	<u>Limit of</u> <u>Detection</u> <u>(ug)</u>
Acetone	0.1	0.1
Benzene	0.51	0.01
Bromodichloromethane	<0.01	0.01
Bromoform	<0.01	0.01
2-Butanone	<0.1	0.1
Carbon disulfide	0.23	0.01
Carbon tetrachloride	<0.01	0.01
Chlorobenzene	<0.01	0.01
Chloroform	0.01	0.01
Dibromochloromethane	<0.01	0.01
1,1-Dichloroethane	<0.01	0.01
1,2-Dichloroethane	<0.01	0.01
1,1-Dichloroethene	<0.01	0.01
1,2-Dichloroethene (total)	<0.01	0.01
1,2-Dichloropropane	<0.01	0.01
cis-1,3-Dichloropropene	<0.01	0.01
trans-1,3-Dichloropropene	<0.01	0.01
Ethylbenzene	<0.01	0.01
2-Hexanone	<0.05	0.05
Methylene chloride	<0.05	0.05
4-Methyl-2-pentanone	<0.05	0.05
Styrene	<0.01	0.01
1,1,2,2-Tetrachloroethane	<0.01	0.01
Tetrachloroethene	<0.01	0.01
Toluene	0.04	0.01
1,1,1-Trichloroethane	<0.01	0.01
1,1,2-Trichloroethane	<0.01	0.01
Trichloroethene	<0.01	0.01
Vinyl acetate	<0.05	0.05
Xylenes (total)	0.03	0.01

* Results are blank corrected.